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*VERSUS*

ITS MODIFICATIONS.

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# LISTER'S SYSTEM OF ASEPTIC WOUND-TREATMENT

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ALL important evolutions in nature, politics, and science are commonly foreshadowed by certain preliminary occurrences. The rising sun is heralded by the increasing light in the east. The approaching storm is proclaimed by certain atmospheric changes and the gathering clouds. Belligerent evolutions in political caldrons are reflected by the public press and the bickerings of the people. The primary effects produced by the Stamp Act and John Brown's raid may serve to illustrate conditions preliminary to war and bloodshed. An essential principle involved in the scientific treatment of wounds was discovered by Francisco Redi in 1668. Redi's experiments proved that maggots are not generated in dead flesh, but from eggs deposited by blow-flies. He was the first to give utterance to this remarkable hypothesis, "*no life without antecedent life.*" The work, begun by Redi, has been thoroughly elaborated by the experimental studies of Vallisnieri, Swammerdam, Reaumur, Schroeder, DuRoi, Pasteur, Beal, Tyndall, and others. They have effectually succeeded in banishing the notion of spontaneous generation; and have likewise shown that fermentation and putrefaction *can only be produced by living germs*. Furthermore, they have pointed out the conditions which are requisite for their growth and multiplication, the various methods by which they are carried from one point to another, and also the means by which their destruction may be accomplished. In fact, the literature of this subject is very voluminous; but it is

thought to be unnecessary to enter more fully, at this point, on its discussion in connection with our consideration of wound-treatment. Allied to these discoveries, which we have briefly mentioned, were the observations made by physicians and surgeons in reference to the action of air on wounds. Galen declared, nearly eighteen hundred years in advance of his time, that the action of the air is often injurious and even dangerous to wounds, on account of the heterogeneous substances which it contains. Acrophobic ideas, similar to those expressed by Galen, were maintained by the following-named distinguished surgeons: Guy de Chayliac, Ambroise Paré, Magatus, Wiseman, Billoste, Pibrac, J. L. Pettit, A. Monroe, John Bell, Sancerotte, Dedalot, Laffize, Champeau, Camper, Lombard, Boyer, and others. It was not until the commencement of the present century that the acrophobic ideas began to bear fruit which gladdened the heart of surgeons. The illustrious Delpech performed tenotomy subcutaneously for the first time, May 19, 1816. The object which he sought to accomplish was the protection of the wound in the tendon from the injurious action arising from contact with the air. He was perfectly successful. His success in this trial aroused in Athens a spirit of emulation, and we find Dupuytren performing subcutaneously myotomy in 1822. Stromeyer modified and improved Delpech's operation in 1831, and Dieffenbach published in the *Archives Générales de Médecine*, in 1835, an account of numerous and remarkable successes which he had obtained. Duval, Bouvier, and Jules Guérin contributed to perfect and popularize subcutaneous operations. The latter contended earnestly in favor of the noxious action of the air on wounds, against Malgaigne, Olliver, and Velpeau, and finally had the satisfaction of partially convincing his opponents of the correctness of his views. The universal success which had attended the performance of subcutaneous operations, the absence of inflammation and suppuration, the great rapidity with which these wounds healed, had not failed to strengthen the opinion, which had been rapidly growing in favor, that the air contained some deleterious agent which exerted an unfavorable influence on all open wounds. In addition to all this, it had been ob-

served that simple or even comminuted fractures are rarely attended with danger to the life of the patient; although they are frequently attended by extensive subcutaneous lacerations; but so long as the principal bloodvessels remain intact, little or no anxiety is felt; nevertheless, it is well understood by all medical men that a compound fracture always endangers the life. Having now summarily alluded to some of the studies, experiments, and observations which were preliminary to the application of the germ theory to the treatment of wounds, it now remains for us to examine into the basis and character of Lister's treatment. This treatment is based essentially on the following conditions: First, the continued exclusion from wounds of all living germs, or the prompt destruction of the same in those cases where they have gained admission, thus preserving in the wound an absolutely aseptic condition until it has healed.

Second. Complete and uninterrupted approximation of the wound surfaces.

Third. The avoidance of all irritation or any disturbance of the relation of the wounded parts.

The most important objects sought to be accomplished by this system of treatment is the complete avoidance of all septic complications, the rapid healing of wounds by first intention or otherwise, the avoidance of all unnecessary danger to the life of the patient, together with as much relief from suffering as may be possible. The most important questions which now present themselves for our examination are, Does the Lister system of treatment fulfil these indications, and thereby secure the above-mentioned desirable results? It must now be admitted that every recognized scientific principle involved in this practice has been thoroughly examined, carefully studied, and fully recorded. It is, therefore, possible for any surgeon who is willing to devote a reasonable amount of time to the study of these records to form a just opinion of the value of these investigations, and the availability of the principles involved in the same for the treatment of wounds. It is not, however, my intention to convey here the idea that all these investigators have reached the same conclusions; but, notwithstanding this fact, it is certainly believed that

every honest inquirer after knowledge may readily discover the truth. It will be undoubtedly necessary for the student who desires to investigate this subject, to commence with the study of the principles involved in the Lister practice; and afterwards carefully analyze all the details of this system of treatment, and likewise its results. The scope of this paper does not enable me to even state the conclusions reached by individual investigators in their study of the principles of this treatment; but, I think, however, it must be generally admitted, and may be demonstrated to the satisfaction of any scientist, that it is possible to render *completely aseptic* nearly *all wounds* and to preserve them in this condition during the entire reparative process by the means employed in the Lister treatment. The accomplishment of this object depends, primarily, on the germicide property of carbolic acid as it is employed, and, secondarily, on the systematic manner in which it is used. It should be remembered that the Lister treatment of wounds is *not an empirical method*, but a *complete system of practice*, based on well-known scientific principles and facts, in which respect it differs widely from all its so-called "modifications." The principles involved in this treatment are now as thoroughly understood as those governing the construction and action of steam engines; and when the same degree of skill and care is exercised in the preparation of the material, and in the application of this wound dressing, as is required in the manufacture of this powerful motor instrument, there is no reason to doubt that the work accomplished by the former will be as satisfactory as that done by the latter. The fact is apparent to all, that the steam engine is only adapted to the performance of certain sorts of work; and it is equally true that the Lister system of wound treatment is limited in its applicability to certain classes of wounds. The surgeon, who would practise surgery successfully, must thoroughly understand the applicability of any wound dressing which he employs, and at the same time make himself familiar with the hygienic surroundings of his patient, as well as his idiosyncrasies, constitutional and local diseases, and the influence of the same upon the wound or injury which he is especially called to treat. Then, complications are

very frequently the cause of unfavorable terminations in cases of injury which otherwise would have been wholly unattended with danger. In order that he may be enabled to form a correct idea of the value of any local wound treatment, it is likewise necessary that the surgeon should recognize the existence of all wound complications, when such are present, since these frequently retard the healing process. The effect of unfavorable hygienic surroundings are certainly less to be feared when an aseptic system of wound treatment is strictly adhered to than under other circumstances, and the same is unquestionably true in some of the other wound complications. During the last fifteen years the high value of the Lister system of wound treatment has been fully attested. The theory on which it was originally based already has been supplanted by well-established facts and scientific principles. Experimentation and observation have established a new era in wound treatment. The old methods of wound treatment are no longer employed, except when modified or improved by engrafting on them certain parts of the Lister system. In one instance it will be found that the old treatment has been supplemented only by drainage-tubes, or the metallic sutures; but, in other cases, it will be observed that the modifications employed cause the treatment to approximate much more closely in its character to the Lister system. In fact, the majority of methods now employed are based essentially on the same principles as the Lister treatment, and it is generally claimed by those who employ them, that they are able to maintain by these means the required degree of asepsis and rest for the wound. Dr. Cheyne remarks on this subject, that: "We are now, therefore, able to take a much wider view of the meaning of the term 'antiseptic surgery' than is generally done. It is no longer surgery which only *excludes* the causes of putrefaction; we may now include under the term *all those methods of wound treatment in which, wittingly or otherwise, the growth and fermentative action of the lower forms of organisms (bacteria) are more or less impeded*. When we come to look at the numerous methods of wound treatment from this point of view, we shall see that there is perhaps none at present employed, with the exception



of the poultice dressing so much lauded by Mr. Savory, which does not, in some way or other, however imperfectly, interfere with the growth and fermentative action of bacteria, and which does not owe its chief virtues to that cause."<sup>1</sup> The strongest argument which can be offered in favor of the practice of Listerism is found in the fact that it has only required fifteen years to so far convince all the surgeons of Christendom of the correctness of the principles on which it is based, that they have, wittingly or otherwise, incorporated into their own methods of treatment, as the chief corner stone, the essential principles of the Lister system. Should additional evidence be required to establish the value of the Lister system of wound treatment, it may be found in Dr. Cheyne's *Antiseptic Surgery*, in which he has devoted two hundred and thirty-three pages to the consideration of the results of this system of practice. He has presented in this portion of his work a *convincing statistical report* from many of the most distinguished European surgeons. The high and well-earned professional character of each individual surgeon whose figures and operations have been quoted by Dr. Cheyne in connection with this subject, would be certainly entitled to a careful consideration in any Surgical Association, but the aggregated testimony of such a large number of eminent professional gentlemen forms a bulwark which cannot be readily overthrown by any power.

The vivid description given by Dr. A. C. Girard, United States Army, of his conversion to Listerism, is deemed worthy of a repetition in this connection, although it was originally published about seven years ago. He says: "During a sojourn abroad last winter my attention was particularly drawn to this innovation in surgery, as it has been introduced on the European continent but two years, and was the almost exclusive topic of conversation of the surgical profession there. It happened that my first intercourse was with some of the most decided and renowned opponents of the system, and I became acquainted

<sup>1</sup> *Antiseptic Surgery*, p. 206.

with all the objections to it before I had witnessed its advantages and benefits.

"I received, therefore, the glowing accounts of Lister's disciples with an incredulous ear, and it was only by travelling from one 'Lister Hospital' to another that belief in its superiority forced itself upon me. I became convinced, that, if it is not the only proper wound treatment, it is the safest one, and renders conservative surgery possible beyond what had ever been believed. It would take volumes to describe all that I witnessed, and I cite but a few examples. Who, before this, would have fearlessly opened the knee-joint for suppurative arthritis, as I saw done under the 'spray,' the patient recovering in a few days with a sound joint? Who would have expected an ovariectomy with general adhesions in a woman of seventy-five to heal in eight days without a symptom of reaction, or a laparotomy for the liberation of incarcerated peritoneal hernia in a moribund patient, healing in six days, or a resection of the ulna in nine days? Hospitals which had been in use for centuries, and had become hot-beds of infection, where the majority of operations, formerly, were followed by pyæmia, gangrene, and erysipelas, where everything had been tried to combat these evils, where treatment, 'open,' 'occlusive,' by 'immersion,' compresses of chlorine water, carbolized water, even Lister's 'gauze,' and 'paste' had failed, became entirely free from these complications as soon as Lister's system with *all* its precautions had been introduced."<sup>1</sup>

The adherents to the Lister treatment have steadily increased in number, in Europe, since Dr. Girard made his report; but there are some surgeons who still oppose it. This opposition is entirely maintained by those who have never practised the Listerian system, and their chief arguments against the practice appear to be based on the fact that in some instances organisms have been found under the "so-called Lister dressing," and that in some other cases a few Listerian surgeons have abandoned the use of the spray. The finding of micro-organisms in the secretions of an aseptic wound has been often questioned, but never absolutely

<sup>1</sup> Surg. Gen. Office, Circular Order No. 3, August 20, 1877.

disproved, although it may now be boldly asserted that observation has fully justified the conclusion, that, if they are ever found under these circumstances, they have certainly *lost their power to cause putrefactive fermentation*, and consequently they can never cause septic infection. In our own practice we have not always succeeded, even with the Lister dressing, in rendering wounds completely aseptic, and we should expect that a microscopical examination, in these cases, would reveal the presence of organisms. We, therefore, conclude that the presence of these micro-organisms in the secretions of wounds which have been treated antiseptically does not justify the assertion that this system of wound dressing is worthless.

We are now brought to the consideration of the abandonment of the spray by a few Listerian surgeons. We are aware that Mr. Keith has expressed a want of faith in its efficacy, even after having had a considerable experience in its use, while other surgeons have abandoned it for irrigation. The efficacy of the latter procedure cannot be questioned by those who admit the germicidal property of the carbolic acid solution in the strength in which it is commonly employed for these purposes. I desire here to call attention to the fact that the spray, when thrown on any solid substance, deposits within a few minutes a continuous layer of carbolic acid solution. It, therefore, follows that the spray having been properly directed on the parts where an incision is to be made, it becomes impossible for any germs to reach the wound without having first passed through the wet line, and, since this is continuous, no germs can pass or even remain in it many seconds without being thoroughly saturated with the solution. It is, therefore, certain that the spray, when judiciously employed, possesses the same efficacy as irrigation; but, that it may be abandoned if certain other precautions are taken to prevent the contamination of wounds during the period in which this agent is commonly employed, without materially affecting the value of the Lister system of treatment. It is thought that the strongest argument that can be urged against the use of the spray, is the fact, that it is always more or less annoying to the spectators, but this *frivolous objection* ought



never to be used against it in any case where it gives additional security to human life.

Having reviewed the principles, practice, and some of the objections which have been used against Listerism, we are now prepared to enter on the consideration of some of its so-called "modifications."

Prof. Thomas M. Markoe, who has suggested one of the most important modifications of the Lister system of wound treatment, introduces his subject in the following complimentary terms: "A verdict, almost unanimous, has been pronounced in favor of Mr. Lister's antiseptic method of treatment of wounds. In a practical point of view it is conceded to be an advance so great and so valuable that it is not easy to find its parallel even among the amazing strides of modern surgery. This favorable verdict has not been arrived at by the overshadowing influence of a great name, nor has it grown out of the teachings of a popular school of medical thought, nor indeed is it merely the result of a general acquiescence in a fashionable theory. It is the expression of the results of a fair and honest trial of the method by men of all schools and in all parts of the civilized world; a trial which, on Mr. Lister's earliest announcement of his views, was begun by a few earnest men with many doubts and with much hesitation; but a trial in which each succeeding witness confirmed the favorable testimony of those who had spoken before him, until, at the present moment, it would hardly be extravagant to assert that there are fewer men who do not acknowledge the practical advantages of Lister's method of treating wounds than there are who do not recognize the usefulness of splints in the treatment of fractures, or of the ligature in the arrest of hemorrhage. This unanimity, moreover, was not arrived at on the earliest experiences of the method, nor were the first trials in every case satisfactory, certainly not convincing. It has grown out of a large experience by competent men who have, after careful study, finally been convinced by what they have seen, and speak therefore of what they know. The indorsement of the leading surgeons in every capital in Europe is enough to establish a practice, of the results of which they would be ac-

cepted as competent judges.”<sup>1</sup> The further perusal of this paper *cannot fail to impress the reader with the idea that Prof. Markoe is perfectly satisfied with the results of the Lister treatment*, and that his present efforts are mainly directed against the application of the germ theory to the treatment of wounds. The questions proposed and discussed in his article, which he has not *even claimed to answer*, show a strong bias in favor of the old antiphlogistic theory of wound treatment, and a prejudice against the more modern opinion on which Listerism is based. In speaking of the queries in connection with Listerism, he says: “I confess I do not think that all these interesting and important questions connected with the antiseptic method can at present be definitely settled, and that perhaps it is wiser to decide that statistics show for the Lister treatment a much larger proportion of success than can be claimed for any method preceding his discovery; but that as yet it is not clearly shown that his method is so superior to all the modifications of it that have been and are now being tried, as to vindicate its somewhat arrogant pretensions to be the true and only gospel of the surgery of wounds.”<sup>2</sup>

The basis of the new departure from Listerism is described by its author in the following language: “The plan itself consists in the free and constant use of appropriate solutions of carbolic acid in water, no care being taken to keep the wound shut off from the influence of the atmosphere, and provision being made for the inner surface and cavities of the wound being constantly, or at least frequently, moistened by the carbolic acid solution. This is the outline of the plan, but its details can perhaps be best presented by describing its application to a case” in which the operation was performed for the removal of a dislocated and diseased astragalus. . . . “The wound, which consisted of a semilunar incision extending from behind and below the internal malleolus in a curved line over the dorsum of the tarsus to the external malleolus, was dressed by bringing

<sup>1</sup> Amer. Journ. of Med. Sci., vol. lxxix. p. 305 *et seq.*, 1880.

<sup>2</sup> Ibid., p. 319, 1880.

the edges together with carbolized silk sutures, a long drainage-tube having first been passed across the deeper part of the wound from one malleolus to the other. This tube had been prepared so that the part within the wound had been perforated with a number of holes, care being taken that all that part of the tube which projected from the wound should be free from openings. The wound was then covered with the ordinary prepared carbolized gauze laid on in three or four thicknesses, first being well wetted with one-fortieth solution of carbolic acid, and so arranged upon the surface of the wound that the ends of the drainage-tube were free as they projected on either side. This we generally accomplished by cutting holes in the dressing opposite the points of entrance and exit of the drainage-tube, though sometimes the tubes could be brought out between the folded pieces of which the dressing was composed. This, retained in position by a few turns of the thin gauze bandage, also wetted with carbolic acid solution, completed the dressing. The limb was then suspended from a framework so that it was raised about six inches from the bed, and swung easily from side to side on every motion of the patient's body. This arrangement was found extremely comfortable, and permitted the drainage from the wound to be freely discharged from the lower opening. Four times a day a solution of one-fortieth carbolic acid was thrown through the drainage-tube with an ordinary syringe, and continued till the fluid discharged at the lower opening was perfectly clear. The result of this manipulation was that the fluid forced by the syringe into the upper end of the tube found its way freely into the cavity of the wound, distending it, and then found its way out at the lower orifice carrying with it all the fluid secretions which otherwise would have been more or less confined within the wound. This distension of the wound by the injected fluid would not of course happen to any great extent if the whole tube, including its lower orifice, were free from obstruction, but it very often happened that the outlet was impeded by plugs of dried pus or by clots, and then the penetration of the fluid to all the recesses of the wound was very complete—a penetration which we considered so desirable that sometimes the lower orifice of the tube was pinched

by the finger and thumb, while the injection was being made, for the express purpose of securing it.”<sup>1</sup> We have now presented, in the author’s own words, the essential parts of his method of wound treatment, which he has offered as a modification of the Listerian system, in order that we may justly compare it with that which he has styled, “the true and only gospel of the surgery of wounds.” We have neither the time nor inclination, at this moment, to discuss fully the principles or theories on which these different plans of wound treatment are based. It should, however, be remembered that the Lister system of treatment aims to secure the *highest possible degree of rest for the wound*, and likewise *immunity from septic complications*; while Prof. Markoe’s is directed especially against inflammation, as is shown by the following question, answer, and comments.

He asks: “Are there any agencies which will control the tendency to inflammation in wounded parts?” . . . “The answer of modern therapeutics would be, I think, unhesitatingly in the affirmative. Leaving out of consideration at present all those indirect influences of which every careful surgeon gladly avails himself, as rest, position, food, medication, regimen, etc., I contend that there are certain agencies which act directly, locally, and at times powerfully, in controlling or even in arresting inflammation. Of these agencies I recognize chiefly three, viz., cold, local blood-letting, and the action of certain drugs. Of the first two I have no occasion here to speak particularly.” . . . “Of the last class of agencies which control inflammation I wish to speak more in detail; and for brevity’s sake I will confine my remarks to one single drug, viz., carbolic acid. The testimony as to the singular power which this drug possesses of controlling inflammation is derived from various sources, and bears upon cases of inflammation attacking mucous and cutaneous surfaces, traumatism and granulating wounds. Some of this testimony is popular and some is scientific.”<sup>2</sup>

Three years have elapsed since Prof. Markoe published his

<sup>1</sup> Amer. Journ. of Med. Sci., vol. lxxix. p. 319 *et seq.*, 1880.

<sup>2</sup> Ibid., p. 312, 1880.

paper on "Through Drainage in the Treatment of Wounds;" and the question may now be properly asked *if his theory* of the action of carbolic acid has not been thoroughly exploded. What has been the experience of the surgical profession in regard to the action of a solution of carbolic acid, when applied in the ordinary manner, *i. e.*, as a douche, or on saturated compresses, or when acid has been mixed with some unctuous substance, such as vaseline, and then smeared over the surface of an open wound? I have employed it, as above mentioned, in a large number of cases; and am, therefore, prepared unhesitatingly to affirm that *it will not prevent, or arrest inflammation* in such instances. Nevertheless, I am prepared to admit that the acid and the "through drainage," when employed as recommended by Prof. Markoe, exert a beneficial or restraining influence on inflammation; although it will *neither prevent nor arrest it*. It seems to me that the beneficial influences arising from this method of wound-treatment *can only be satisfactorily explained* by the more or less complete removal of the wound fluids from the wound, and a moderate degree of antiseptis exerted by the carbolic acid solution. It is a well-known fact that the wound fluids form the only *nidus* in which occurs primarily the multiplication of the micro-organism in these cases, and the germicidal property of carbolic acid has been thoroughly established. Furthermore, the fact that the Lister system of treatment, when properly employed, enables the surgeon to *prevent all inflammation in wounds*, must be accepted as a strong argument in favor of the antiseptic, and not the so-called "antiphlogistic" action of carbolic acid. The further study of our subject brings us to the consideration of the *great advantage arising from infrequent dressings* in all cases of recent wounds. Mr. Sampson Gamgee, F.R.S.E., has wisely remarked that, "Once a recent wound has been nicely adjusted, the less it is interfered with the greater the chances of healing. Under such circumstances, to meddle without good reason is to muddle."<sup>1</sup> It is very certain no experienced surgeon will attempt to refute the opinion expressed by

<sup>1</sup> The Treatment of Wounds, p. 9 *et seq.*, 1878.



Mr. Gamgee on this subject ; and the importance of his views is never better illustrated than in amputations of the extremities, where the cut surfaces should be placed and kept in absolute contact with each other, if possible, during the entire healing process. The distension of these wounds by the impeded fluids ought never to be effected if it can be avoided, since it *seriously interferes with the healing process*. It would, therefore, appear that this proposed modification of Listerism carries with it its own condemnation in the following : "This distension of the wound by the injected fluid would not, of course, happen to any great extent, if the whole tube, including its lower orifice, were free from obstruction ; but it very often happened that the outlet was impeded by plugs of dried pus or by clots, and then the penetration of the fluid to all the recesses of the wound was very complete—a penetration which we considered so desirable, that sometimes the lower orifice of the tube was pinched by the finger and thumb, while the injection was made."<sup>1</sup>

We are now satisfied that the majority of surgeons are prepared to admit that the *system or method of practice* which gives the most complete rest to the wound while it is healing, and at the same time the most complete immunity from septic complications, *is the one which will always yield the best results*. I have examined from these standpoints not only Prof. Markoe's modification, but the most of those which have been proposed, and I am now fully prepared to assent to the following statements made by Dr. Just. Lucas Championniere : "Perchance, in exceptionally favorable conditions, one may omit some parts of the dressing which are indispensable in bad surroundings ; but the *ensemble* of the method must remain, and is demanded in the country as well as in town. Certain operations are justifiable only under its protection. Whatever has been the progress of modern surgery, the antiseptic method came at a time when the surgeon, often disarmed by surgical complications, saw his horizon limited by cruel uncertainties. It was impossible to predict the results of operation, and security was so imperilled

<sup>1</sup> Amer. Journ. of Medical Sciences, vol. lxxix. p. 321, 1880.

that certain conditions appalled the boldest, and certain operations were practically prohibited to the surgeons of cities; who, even though consummately skilful, found themselves unable to produce results equal to those of their far from expert brethren in the country, where the atmosphere is untainted. The antiseptic method came, and gave an impetus to surgery, for it provided skill with the means of success. This new power of surgery, it seems to me, can be acquired only by faithful disciples. . . . Approximations to antiseptic surgery, and attempts at imitating it, have everywhere ended in cruel disappointment. . . . But one can easily understand that, until it is acknowledged as a matter of surgical duty, only a small number will rigorously follow the necessary practice and attain satisfactory results. . . . Whatever I state I have tried and observed. I have educated myself upon all these points, and confident of success, I have fearlessly performed operations which formerly one would scarcely have ventured on. I assert more emphatically than ever, that we can do no better than to remain faithful to the words of the master."<sup>1</sup>

<sup>1</sup> Championniere's Antiseptic Surgery. Translated and edited by F. H. Garrish, A.M., M.D., p. 14 *et seq.*







